

Access to technical & business support to implement nanotechnologies





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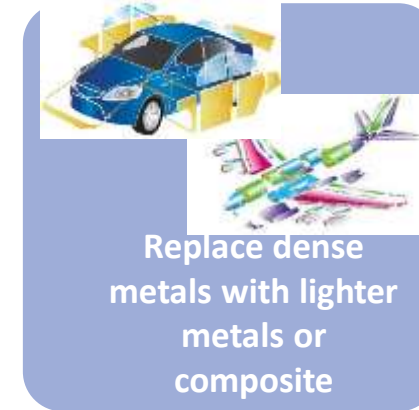
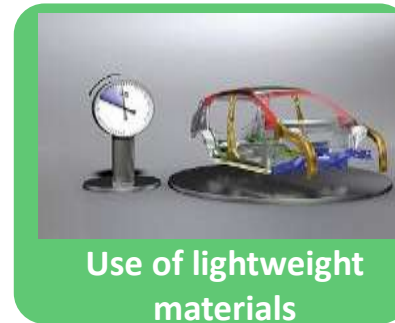


Open Access Single entry point for scale-up of innovative Smart lightweight composite materials and components

Innovation action-GA 814581



PROBLEM



PROBLEM:

1. **Composites and lighter metals individually: Insufficient properties:** do not meet all requirements for mechanical, electrical or thermal abilities
2. **Nanotechnology** cannot easily be introduced into composites and metallic supply
3. **Lack of industrial scale** manufacturing of nano-enabled products
4. **Not sufficient quantities** are currently produced for the high demanding industries
5. **High Cost** of intermediate nano-enabled products, especially for SMEs
6. **Tailored solution for each application:** different chemical content, production process, etc
7. **Limited accessibility** to SME producers

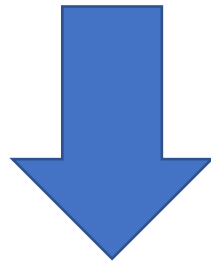




PROBLEM



NANOTECHNOLOGY + ADVANCED MATERIALS
ADVANCED MANUFACTURING



LIGHTER MULTIFUNCTIONAL ESTRUCTURES





PROBLEM



Companies and new technologies- Introduction of nanotechnologies in metallic and polymer composites in **today's industrialized systems** as part of advanced materials and advanced manufacturing processes

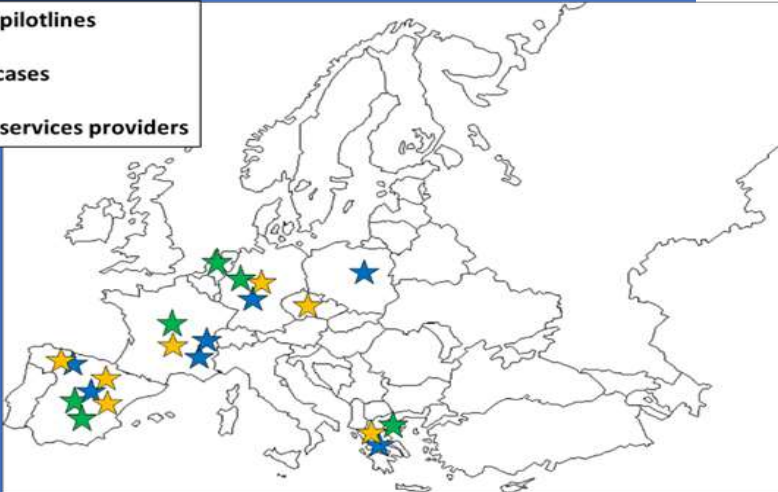


Bottlenecks

- Need for specialized expertise
- Investments cost too high
- Novel techniques not a priority
- RTO not offer facilities and services covering the full value chain
- Development of new products may require Access to finance and optimised business plan



- ★ OASIS pilotlines
- ★ Show cases
- ★ OASIS services providers



SOLUTION



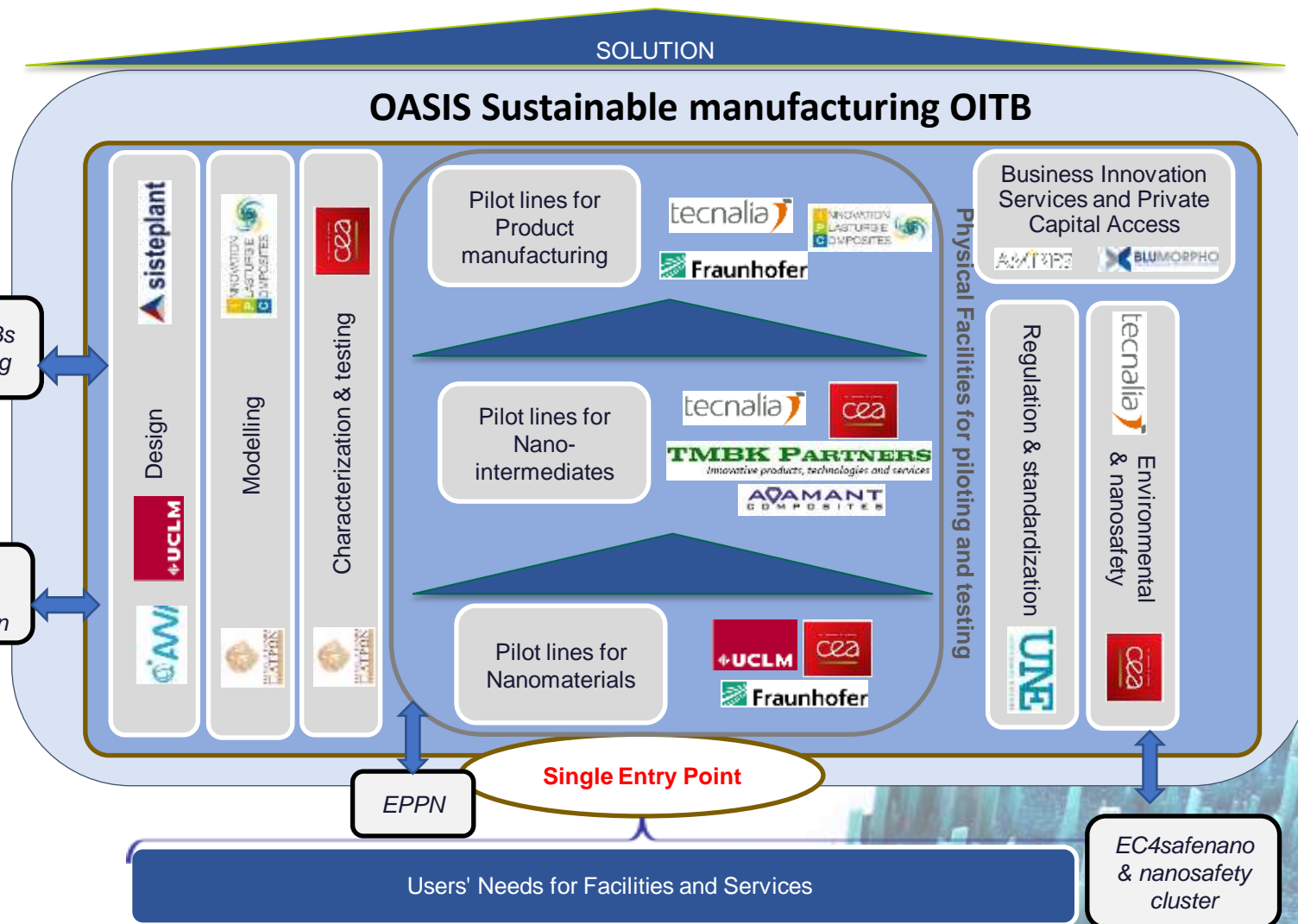
- 20 Companies and organizations from 7 European countries
- Advanced manufacturing facilities ecosystem:
 - 12 Pilot Lines for nano-enabled lightweight materials
 - Technological services
 - Business support services

Develop and organize a **sustainable Open Innovation Test Bed** for innovative scale-up of smart lightweight aluminium and polymer-based composite compounds and products to which

Companies - and more precisely SMEs - can gain access through a **SEP** to **develop, test and adopt, new lightweight**, high performance, **multifunctional**, safe and environmentally friendly high value **materials, components and structures** in a cost-effective and sustainable way

EMMC/OITBs
for modelling

EMCC/OITBs
for characterization



OASIS- ADVANCED MANUFACTURING FACILITIES ECOSYSTEM



Pilot lines for nanoscale structures in unprocessed form with intrinsic functionalities

- SiO₂ nanoreinforced aerogels
- Nanoparticles and nanomaterials synthesis by wet chemical route
- Magnetic and flame retardant nanoparticles and nanocomposites



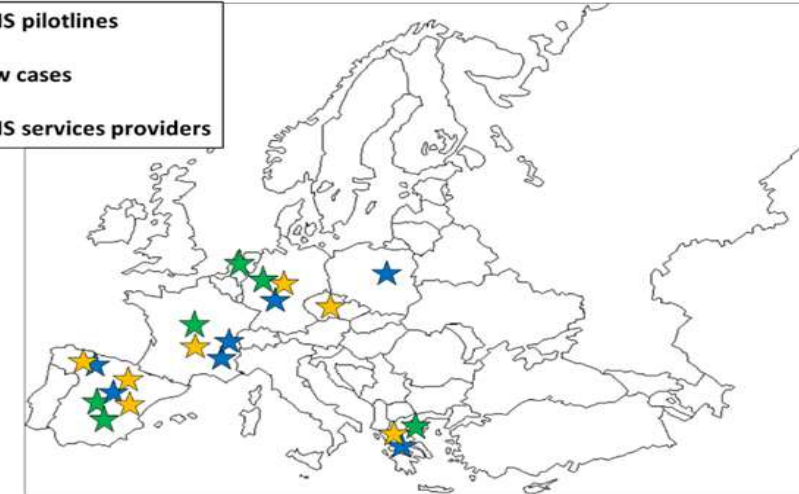
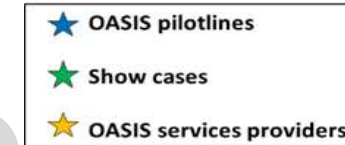
Pilot lines for intermediate product with nanoscale features

- Buckypapers
- CNT treated thermoplastic veils
- CNT treated preregs
- Sheet to sheet smart printed sensors and actuators
- Nanoreinforced metallic alloy ingots



Pilot lines for Nanoenabled-products

- Nano-enabled injected cast parts
- RTM polymer based composites
- Nano-enabled Al/composites hybrid products
- Nano-enabled pultrudates



OASIS Sustainable manufacturing OITB



12 PILOT LINES

Competitive, quality, safe, environmental friendly production of nano-enabled products

Development and commercialization support of lightweight multifunctional products based on aluminium and polymer composites

TECHNICAL SERVICES

From primary concept to final qualification of the product

- ✓ Material selection
- ✓ Manufacturing processes
- ✓ Product and process Design
- ✓ Modelling & simulation
- ✓ Characterisation & testing
- ✓ Sustainable-manufacturing diagnosis
- ✓ Environmental and nanosafety
- ✓ Safe-by-design approaches
- ✓ LCA (recycling concerns)



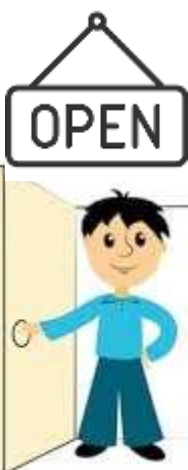
business support SERVICES

Accelerate market commercialization

- ✓ Diagnosis methodology
- ✓ Training
- ✓ Business support
- ✓ IP
- ✓ Coaching to SMEs
- ✓ Access to finance/investors

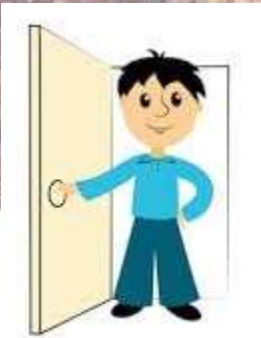


SOLUTION



SEP

Pilot line facilities are efficient catalysts for innovation, helping overcoming upscaling barriers and the “crossing of the valley of death” between invention and market.

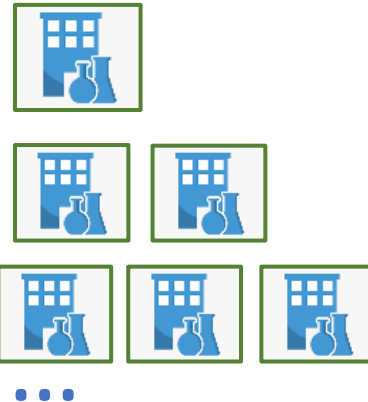


Validation of upscale/upgrade of pilots and services



OASIS Sustainable manufacturing OITB

PILOT PLANTS



TECHNICAL SERVICES

- ✓ X
- ✓ Y
- ✓ Z
- ✓ ...



BUSINESS-SUPPORT SERVICES

- ✓ A
- ✓ B
- ✓ C
- ✓ ...



SEP

ONE STOP
FULL
PACKAGE
OFFER

Nano-enabled pultrusion for lightweight construction

Structural nanoreinforced Al castings by HPDC process

Multifunctional heatable pannels

Energy Storage in prefabricated walls

Multifunctional nanobased layer for aeronautical structure

Battery module nanocomposite packaging



OASIS Sustainable manufacturing **OITB**

PILOT PLANTS



TECHNICAL SERVICES



business support
SERVICES



OPEN CALL (OC)

- New SMEs
- Industries
- Individuals
- Acaemia
- RTOs

Will be attracted

DEMOCASES (6 months)
Development of specific demonstrators
Access to specific services

MULTIFUNCTIONAL NANO-ENABLED PRODUCTS



OASIS Open Call

Roman Pašek, AMIRES



Open access single entry point for scale-up of innovative Smart lightweight composite materials and components
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 814581



What?

- **Project acronym:** OASIS
- **Project full name:** Open Access Single entry point for scale-up of Innovative Smart Lightweight composite materials and components
- **Project grant agreement number:** 814581
- OASIS, an Open Innovation Test Bed ecosystem of 12 nanotechnology manufacturing pilot lines, is organizing an Open Call for Democases with the objective of providing support to organizations in order for them to **develop and test novel nano-enabled products** taking advantage of top-notch European infrastructure.
- Specifically, the aim of each supported Democase will be to transform a product idea into a **functional product/part demonstrator** and develop its associated **exploitation plan** targeting early market adoption.

When?

- The Call will be open from **29th June 2020 to 31st July 2021** and applicants will be able to apply anytime.
- Submitted proposals will be evaluated following one of the two cut-off dates
 1. **31st January 2021**
 2. **31st July 2021**
- Applicants can work on their proposals in the system up until the cut-off date (deadlines at 5 p.m. CET for both). However, after they „**submit**“ their proposals, **they won't be able to change them anymore.**

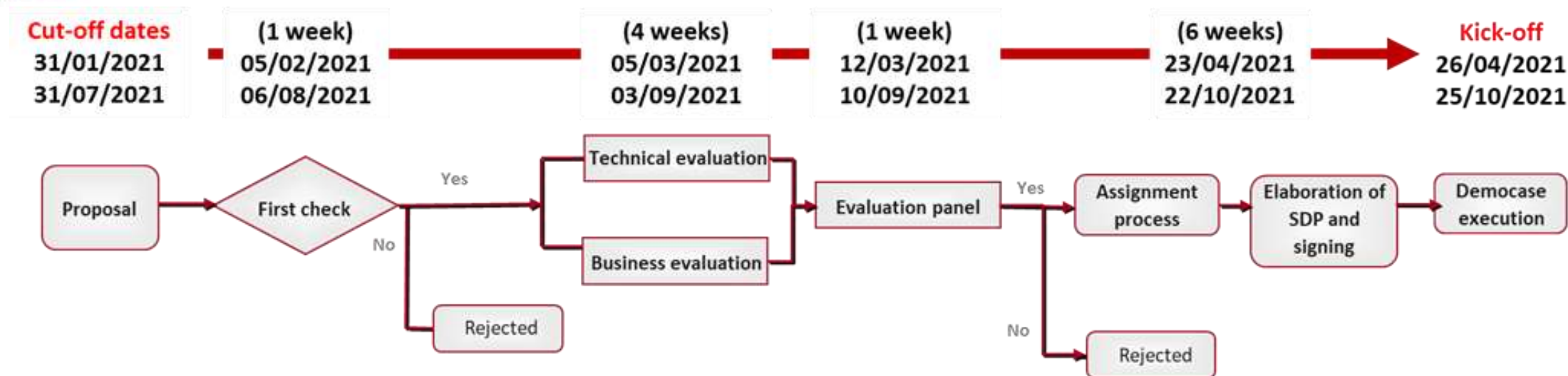
Who?

- The call is open to all organizations regardless of their type, size or field of activity. The following categories are being used in the Call:
 - PRC (Private for profit, excluding education)
 - **SME (Small and medium-sized enterprises)**
 - REC (Research organisations)
 - HES (Higher or secondary education)
 - PUB (Public body, excluding research and education)
 - OTH (Other)
- Important:
- Given the project's aim of fostering the competitiveness of European businesses, the primary target of the OASIS Open Call are **Small and Medium-sized Enterprises (SMEs)**. A minimum of **50%** of the supported Democases will be dedicated to SMEs, provided they score above the required threshold. **Which means they may take priority over higher ranked proposals submitted by other types of organizations.**

Why?

- All successful applicants to the OASIS Open Call will get **free access** to an ecosystem of 12 nanotechnology manufacturing pilot lines, providing nanomaterials, nano-intermediates, nano-enabled products and associated services for the development and commercialization of **lightweight multifunctional products based on aluminium and polymer composites**.
- The selected applicants will be provided with **customized support** through a complete set of services integrating **technical and business expertise** which will enable them to build up sustainable business cases.
- The free of charge contribution by the OASIS consortium is composed of:
 - Qualified human resources dedicated to the execution of the Democase.
 - Consumables and materials required for the product demonstrator.
 - Access to top-notch equipment and infrastructure of the pilot lines.

Process?



- Submitted proposals will be evaluated by 4 evaluators (2 for technical and 2 for business aspects). The maximum overall score is 15. The standard **threshold for individual criteria is 3**, and the **standard overall threshold is 10**.
- However, apart from the proposal-level evaluation there will also be a **portfolio-level assessment** done by the Evaluation Panel which will take into consideration also other factors like balanced use of the services and the available capacities to execute the Democases. **These factors might change the final ranking of the proposals.**

How?

1. Check out www.project-oasis.eu.
2. Browse through the [Catalogue of Services](#) to see how they match your needs.
3. Download & read the [Application Guidelines](#).
4. Register through the submission software at <https://apply.project-oasis.eu/>.
5. Fill in the application data including your preliminary choice of services (a minimum of 2 technical and 1 business supporting service).
6. Download the Application Form from the software.
7. Complete the Application Form, save it as a PDF file (MAX 5 pages), upload it and submit it through the submission software.

Contact

- If you need assistance with applying to the Call, or explanations about technology offerings and your possibilities with OASIS, please send us your enquiries by phone to: +420 226 217 422 or by email to helpdesk@project-oasis.eu.
- Helpdesk will be active Monday - Friday from 9 a.m. to 5 p.m. We will be happy to help you.
- **We encourage all applicants to check the technical and business feasibility of their ideas well in advance of submission.**

Thank you!

Roman Pašek

AMIRES

pasek@amires.eu



Showcase 5

Multifunctional nanobased layer for aeronautical structure

Asunción Butragueño, Airbus Commercial

Airbus

Airbus is an international pioneer in the aerospace industry. We are a leader in designing, manufacturing and delivering aerospace products, services and solutions to customers on a global scale.



Commercial

Helicopters

Defence

Space



Showcase 5

The Problem

- Optimization of structures and new manufacturing process lead in more complex parts
- Use of composite material



**Bonded repair of defects or damages occurring in composite structure of aircrafts.
(weight, customer satisfaction, energy consumption)**

State of the art

Current methods are limited in size and shape:

- Local heating systems:
 - Not flexible enough (thermal blankets)
 - Not effective over 100% of the surface (hot air boxes)
- The complete composite part has to be heated when curing (production and repairing), which makes it costly and could damage the part.

Technical requirements

- Processing parameters
 - Curing temperature: $180^{\circ}\text{C} \pm 5^{\circ}\text{C}$ for 2-3 hours
 - Heating rate: $0.5\text{-}2.5^{\circ}\text{C}/\text{min}$
 - P: 7 bars for fresh prepreg curing. 3 bars for bonding of precured panels.
- Integrated solutions, system weight $<100\text{gsm}$.

Showcase 5

The Solution

- Out-of-autoclave (or cold autoclave) composite curing process using a localized resistive heating sheets to be used in simple and complex panels (standard epoxy cure cycles)
- Heating system to be integrated (or not) in the structure (as last ply); in case integrated it has to be used as SHM sensor.
- Main objectives
 - Curing of composite materials (during production or repair) with a flexible heating means avoiding the heating of the complete composite part
 - SHM system based on the integrated heating system in the structure

1.External flexible heater blanket

Based on buckypapers (BP).

- For part curing
- For repair curing

2.Integrated heater element

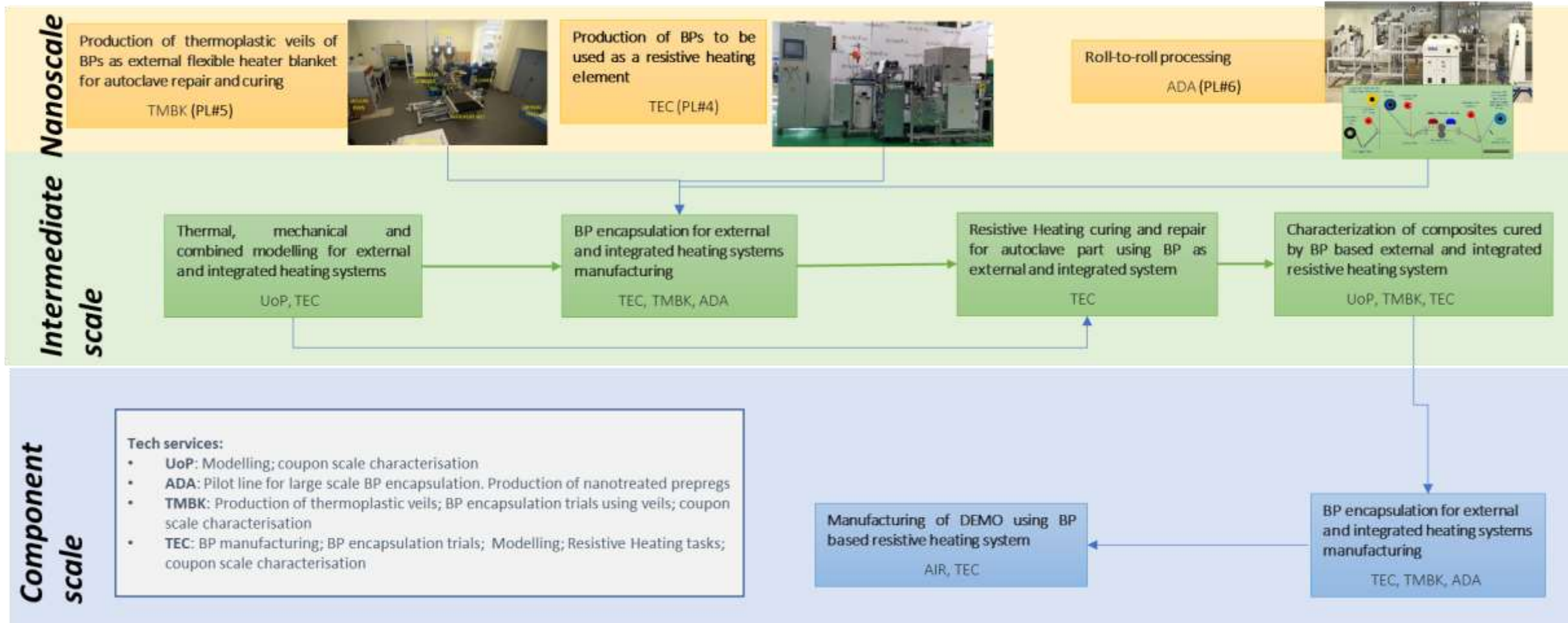
Based on buckypapers (BP)

- For part curing
- With additional functionality (e.g. SHM)



Showcase 5

The Service Used



Showcase #6:

Energy Storage in sound absorbing prefabricated panels

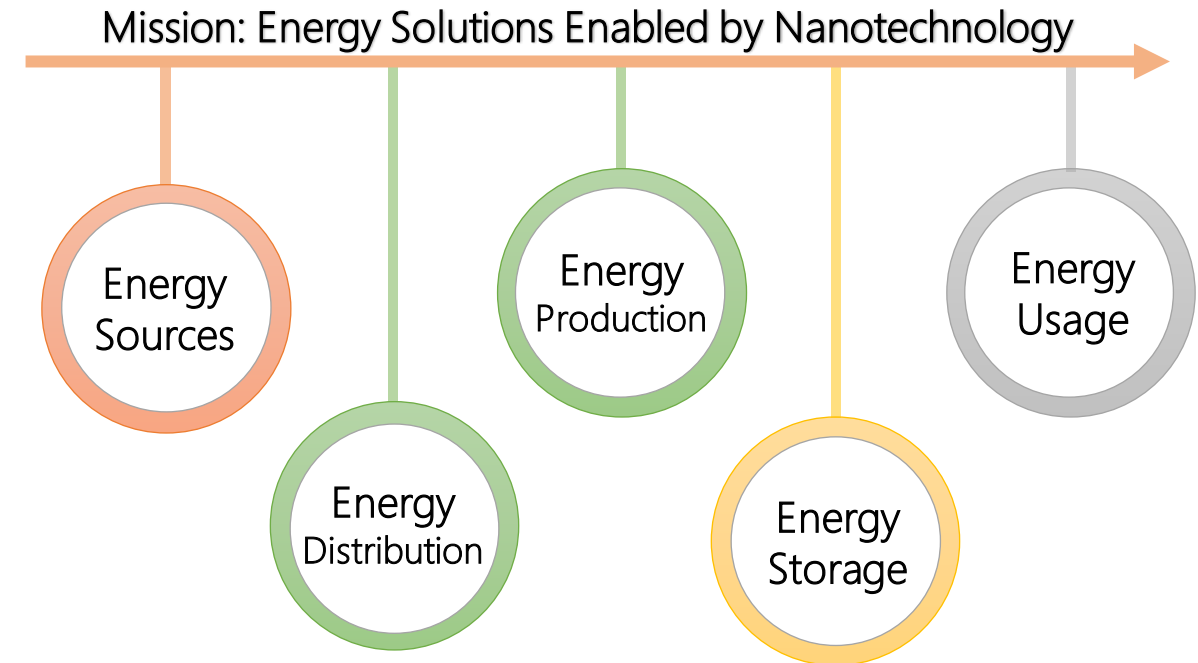
Kalogridi Zampia, Pleione Energy

Pleione Energy Overview



- Established in 2015
- International Joint Venture between a German and Greek company
- Location: NCSR Demokritos, Athens, Greece
- 6-strong team of engineers (50% PhDs & 50% MSc)
- Shareholders:
 - 51% Adamant Composites Ltd
 - 49% Omnidea-RTG GmbH

ADAMANT
COMPOSITES



Establish a fast commercialization of nanomaterials-based applications for energy storage in space and other sectors



Open access single entry point for scale-up of innovative Smart lightweight composite materials and components
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Pleione Energy Activities



Core Technology (R&D) Development

Explore the potential of graphene and other nanomaterials on current and future energy storage technologies.



Product Development / Execution

Develop products in focused markets enabling further the energy transformation.



Role in OASIS

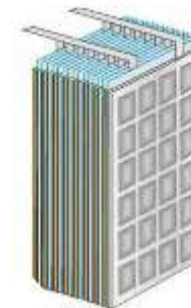
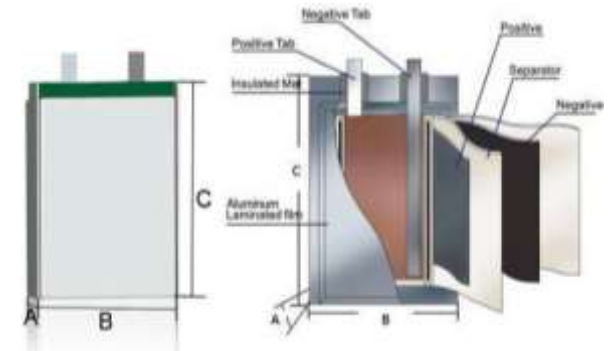


Pleione Energy is the end-user of Showcase 6: Energy Storage in sound absorbing prefabricated panels.

The aim of this task is the development of a sound absorbing prefabricated lightweight panel with **integrated energy storage capabilities** and **advanced functionalities** in terms of environmental sensing and safety.

Key Performance Indicators (KPI):

KPIs		Description	Target at end of activity
KP1	Increase Cell capacitance (F) of the storage cells		up to 180F
KP2	Final Unit Performance: enhanced life cycle compared to commercially available battery storage systems – power banks		5-time longer life cycle
KP3	50% less charging time of our system compared to conventional power banks (at least 3 hours)		Target Charging Time: 1.5 hour (final cell charging rate 2-3A)
KP4	The developed prefabricated panel will charge multiple devices simultaneously with different voltage and current levels		Simultaneously charging devices: 3 mobile phones at and 1 laptop



Challenge



Li-ion energy storage systems (Li-ion batteries) are problematic in the long run, with the key issues being:



1. High Cost
2. Limited durability of all batteries (< 5000 cycles)
3. Low charging rate
4. Performance Degradation (50% in the first 3-5 years)
5. Not Environmentally Friendly



Solution



Development of a Prefabricated Lightweight Sound Absorbing Panel with integrated energy storage capabilities and advanced functionalities (environmental sensing and safety).

Buckypapers provide essential improvement potentials for the development of energy storage systems!

The prefabricated sound absorbing panels can not only absorb sound waves to reduce general noise and limit reverberation in walls within enclosed areas, but also charge electrical devices.

The **innovative step** is the combination of composites and novel energy storage materials into a durable, high-performance and cost-effective product.



Sound absorbing prefabricated energy storage panels



The prefabricated soundproofing energy storage panels would be ideal in a variety of spaces!



Office Table Separators



Meeting Pods



Meeting Condos



Hotel Waiting Area



Separator /
Paravan



Libraries



Conference Room / Exhibitions

Key Benefits



Final Unit Performance

The proposed system is expected to have enhanced life cycle: 5-time longer life cycle (10.000 operational cycles) compared to 2000 operational cycles of commercially available battery storage systems – power banks



Fast Charging

It will have 50% less charging time (1.5 hour) compared to conventional power banks (at least 3 hours)



Better Performance

It will also have increased Cell capacitance (F/g) of the storage cells (180F/g instead of 75F/g) and can charge multiple devices simultaneously with different voltage and current levels (from 5Volt to 20Volt)

OASIS Services Used



PL#4 Buckypapers / Owner: **tecnalia**



Electrodes:

1. Functionalities: Mechanical and electrical properties
2. Role: PL#4 will develop and provide tailorable Buckypapers
3. Target: BP electrical and mechanical properties will be adapted to the specific requirements of the industry show case

PL#6. FXPly™ CNT treated preregs / Owner: **ADAMANT COMPOSITES**



Eco and functional Preregs:

1. Functionalities: Eco-friendly, Recyclability, Fire – retardancy, integrating Sensing
2. Role: R2R integration of the functionalities in the selected preregs to be used for the fabrication of lightweight panels
3. Target: Combination of the PL6 with other PLs

PL#3 Nanocomposites / Owner: **Fraunhofer ISC**



Nanoparticles and nanocomposites

1. Functionalities: Inductive heat
2. Role: Flame retardant nanoparticles
3. Target: Magnetic nanoparticles with inductive heat ability will be synthesized and examined for their integration into the prefabricated panel

PL#7 PICTIC Sheet to sheet Printed devices / Owner: **cea**



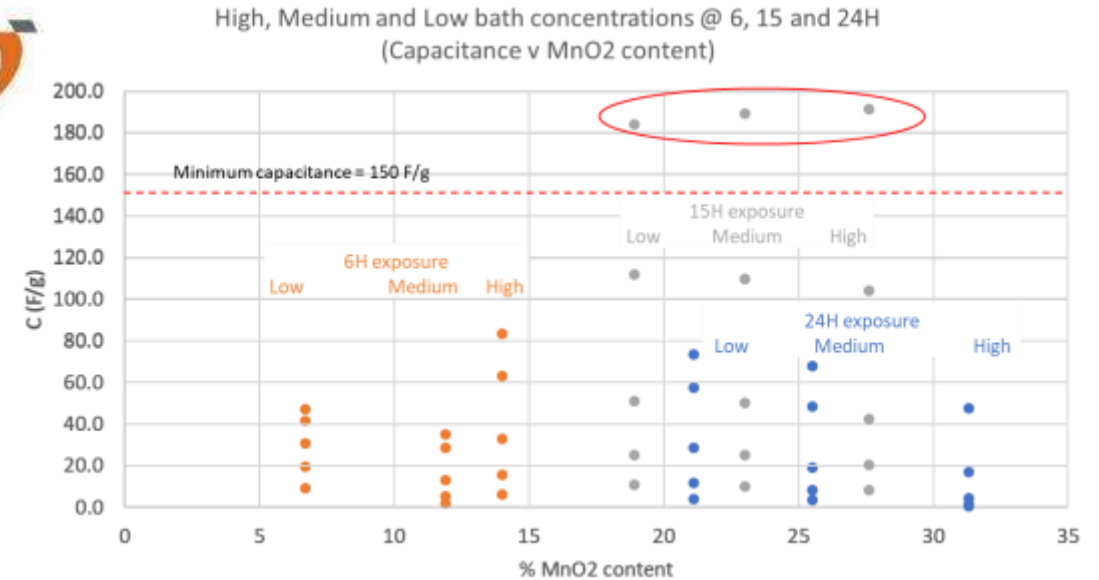
Smart printed sensors:

1. Functionalities: Smart sensing
2. Role: Sheet to sheet printed devices
3. Target: printed electronic components which can be processed and integrated on the nanocomposite substrate



BP electrode production

- Production of **Buckypapers (BP)** with / without modifiers for energy storage electrodes with enhanced performance
- Treatment of **BP with MnO₂** - capacitance > target threshold value (>150 F/g)
- Direct **integration** of Cu foil (current collector) during BP manufacture
- **Electrochemical testing** and morphological characterization of novel nano-based electrode materials



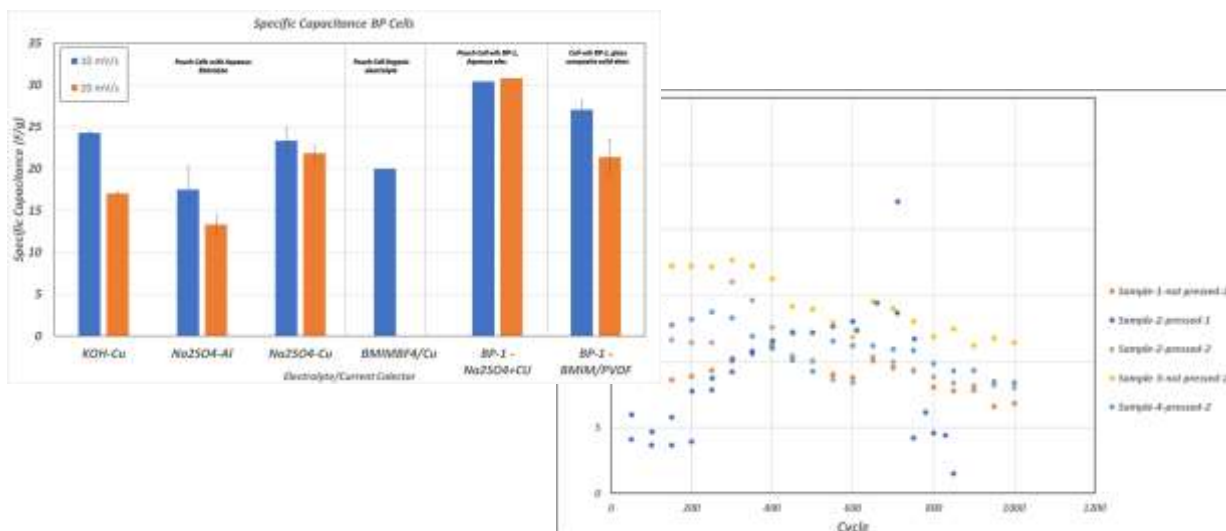
15H deposition time at all 3 concentrations develops BP electrode with initial capacitance above target level (180-195 F/g)



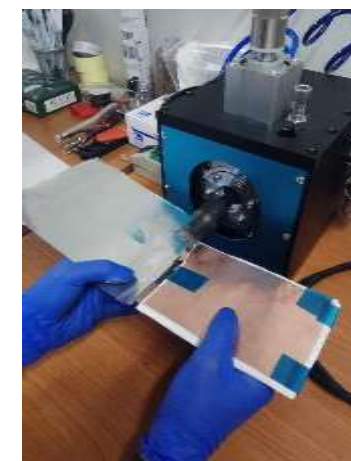
Supercapacitor Cell Design and Development



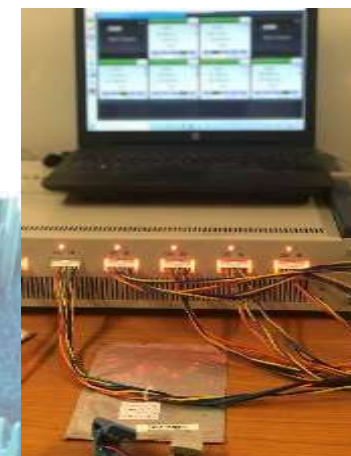
- Cell design: Investigation of various substrates and electrolyte/current collectors – conclude on Pouch Cell with BP made on Cu foil and organic electrolyte
- Supercapacitor cell development: Small pouch cells with one pair of electrodes (5x5 cm), Current: 10 mA, Potential window: 0.55 – 2.6 V reached up to 1000 cycles
- Electrochemical testing at electrode and cell level



Aqueous Electrolytes



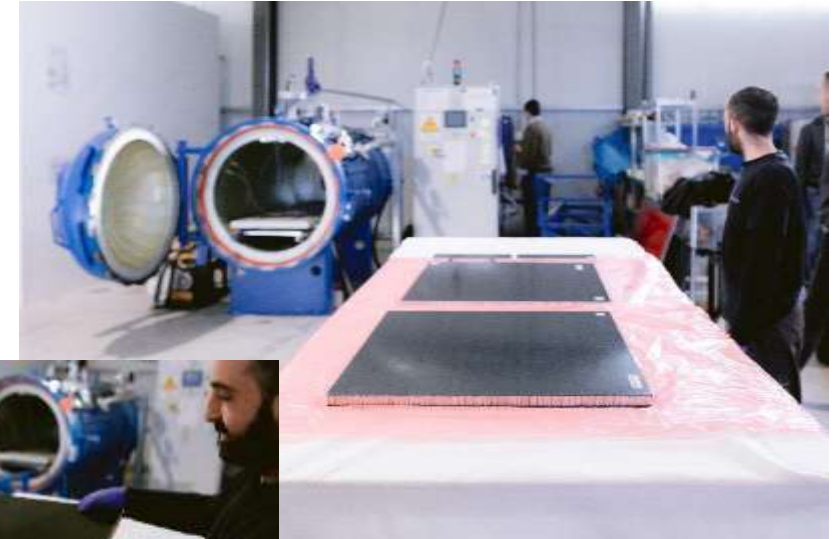
Organic Electrolyte:



Prefabricated Panel Development



- Panel dimensions and architecture options of the final system
- Eco-friendly/recyclable fibre reinforced composite materials: The material selection and the construction method provide strength in tension and fire resistance (fire retardant prepreg for panel face sheet and thermoplastic honeycomb sandwich core)
- Process design for the **prefabricated panel production**
- **Prepreg treatment** for integration of fire retardant nano-particles
- **Test plan** developed at coupon level



Additional Functionalities

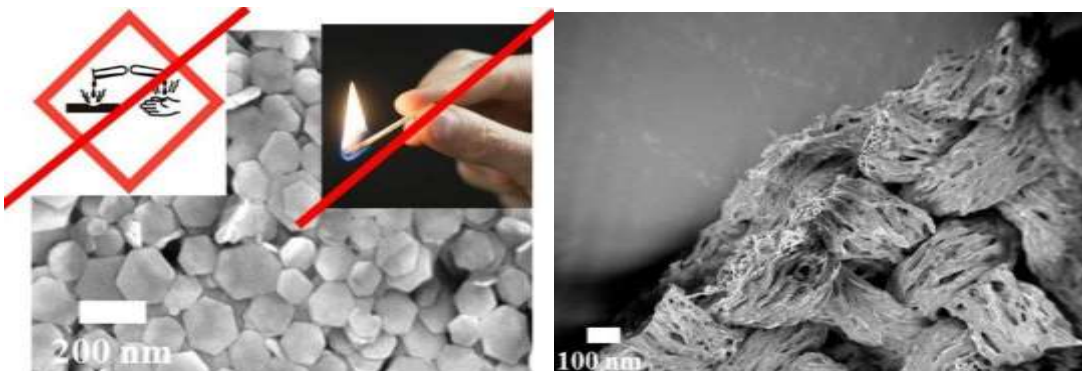


Additional Functionalities in terms of flame retardancy

- **Magnetic nanoparticles with inductive heat ability** will be synthesized and examined for their integration into the prefabricated panel

Additional functionalities in terms of electronics and sensing of environmental conditions

- **Printed electronic components (sheet to sheet smart printed sensors)** which can be processed and integrated on the nanocomposite substrate



Flame retardant nanoparticles

Framework structure of flame-retardant fabrics according to small burner test



Smart Electronics/Sensors printed on flexible substrates

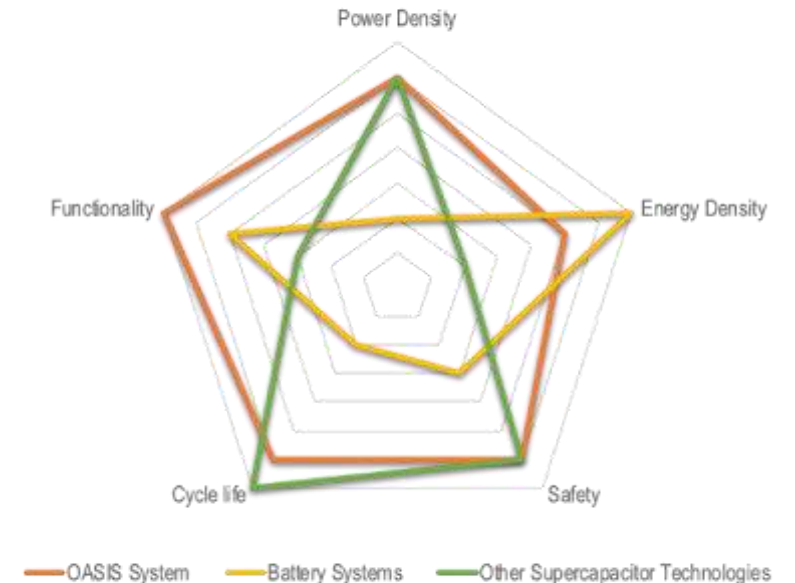
Sheet to sheet printed devices

Unique Selling Points

- **Fast-charge technology** (BP supercapacitor) with improved performance in terms of durability and energy storage. Poor quality batteries that are used in the power banks can ruin their health and lifecycle, which can destroy the end-user experience.
- **A portable prefabricated panel for charging several mobile devices, such as tablets and smartphones.** Unlike battery-based power banks, it can **charge high-power devices** like PCs, laptops, etc. The Supercapacitor Panel can also charge multiple devices **simultaneously** with different voltage and current levels.
- **Very Low charging time of the Supercapacitor Power Bank.** This is 50% faster than a typical Battery Power Bank.
- The product is ideal in a **variety of spaces** that the end-user needs to reduce noise but also charge/power their mobile electrical devices (laptop, mobile phones, etc.)
- It can also be **tailored to the customers' requirements** and specification. All finishes and dimensions can be designed according to their budget and application.
- **Eco-friendly and safe materials** used
- Additional **environmental sensing functionalities**



Competitive Advantages



Advantages of attending the OASIS project



- ✓ Services matching clients' needs;
- ✓ High-level and reliable nano-based solutions supply and development covering the whole development chain;
- ✓ De-risking before full production by gaining access to unique facilities and knowledge without high capital investment (12 pilot lines);
- ✓ Cooperation between partners to combine expertise of different nano enabled technologies;
- ✓ Gain access to other complementary technical (modeling, characterization, toxicology, life cycle assessment) and non-technical services for accelerated innovation studies and guaranteed success in industrialization, market penetration and commercialization.



Zampia Kalogridi
Chief Operating Officer

PLEIONE ENERGY S.A



📍 NCSR DEMOKRITOS

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Timeline

- Recordings can be accessed on project-oasis.eu

✓	 Nano-enabled pultrusion for lightweight constructions	ACCIONA	
✓	 Structural Nanoreinforced aluminum castings	Ford-Werke	
✓	 Multifunctional RTM composite panels	VDL Fibertech Industries	
✓	 Smart battery casing in nanocomposites	Thales	
✓	 Multifunctional nanobased layers	AIRBUS Operations	
✓	 Energy storage in prefabricated walls	Pleione Energy	

Timeline

- Introduction of the Showcases July - November 2020
 - Recordings can be accessed on project-oasis.eu



- Application Deadline:

1st batch: 31 January 2021 (5pm CET)

2nd batch: 31 July 2021 (5pm CEST)

- Start of Democase development:

1st batch: May 2021

2nd batch: November 2021



Thank you!

